ISBN 0-7729-3196-8

PHYTOTOXICOLOGY MOSS BAG ASSESSMENT SURVEY IN THE VICINITY OF NUODEX CANADA LTD. 34 INDUSTRIAL STREET, TORONTO JUNE through OCTOBER, 1986

ARB-056-87-Phyto

November 1987

Ministry of the Environment
Ontario

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Air Resources Branch

ISBN 0-7729-3196-8

Phytotoxicology Moss Bag Assessment Survey in the Vicinity of Nuodex Canada Ltd. 34 Industrial Street, Toronto June through October, 1986

by

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Report Abstract

A moss bag survey was conducted in the vicinity of Nuodex Ltd. during 1986, as in 1985, to determine the status of emissions of mercury and of other metals from the company. Both years' results indicated that Nuodex is a minor emission source of mercury and that Nuodex emissions were not a significant source of cadmium, calcium, chromium, copper, lead, molybdenum, nickel or zinc.

RÉSUMÉ

En 1986, tout comme en 1985, on a effectué à proximité de Nuodex Ltd. une série d'échantillonnages à l'aide de filtres garnis de mousse végétale. Il s'agissait de mesurer les quantités de mercure et d'autres métaux rejetés dans l'atmosphère par l'usine. D'après les résultats des deux années d'étude, Nuodex est bien une source mineure de mercure; par contre, les rejets de l'usine ne constituent pas des sources sensibles de cadmium, calcium, chrome, cuivre, plomb, molybdène, nickel et zinc.

Phytotoxicology Moss Bag Assessment Survey
in the Vicinity of Nuodex Canada Ltd., 34 Industrial Street, Toronto
June through October, 1986

The moss bag survey conducted during 1985 (June through November) in the vicinity of Nuodex Canada Ltd., 34 Industrial Street, Toronto was repeated during 1986 (June through October). The purpose of both surveys was to ascertain the status of Nuodex emissions of mercury and of other elements (cadmium, calcium, chromium, copper, lead, molybdenum, nickel, zinc) Nuodex uses in its manufacturing process.

These surveys were requested by Mr. P. Wolfe, MOE, Central Region and followed the accidental discharge of phenylmercuric acetate (PMA) from Nuodex in August, 1984. This discharge resulted in contamination of soil and driveway areas in the vicinity of Nuodex (see reports - ARB-90-85 and ARB-168-85). A soil-driveway clean-up program followed and the final phase of the clean-up was not completed until October, 1985. The 1985 moss bag results have previously been reported (see report ARB-70-86).

Results of Moss Bag Survey and Driveway Sampling in 1985

During each monthly moss bag exposure period in 1985, mercury levels were found to be elevated at moss sites in the immediate area of Nuodex, with the highest levels being detected at Sites 3, 6 and 2 to the immediate west, southwest and northwest, respectively (see attached Figure 1).

In addition to the moss bag survey, surface scrapings were collected in October, 1985 from nine unpaved driveway sites in the vicinity of Nuodex (see attached Figure 2). These samples were sieved and the light soil-dust fraction was analyzed for mercury and seven other metals. The driveway soil-dust collected at most sites was found to have elevated mercury levels with the level detected at two sites (2 & 3) exceeding the proposed 10 ppm soil clean-up level (see Figure 2). Excessive levels of cadmium (Sites 1, 2 & 3), chromium (Site 2), and lead (Site 2) also were detected at the driveway sites shown in parenthesis (see Figure 2). At moss Sites 3 and 6 (the highest mercury contaminated moss bag sites in 1985), a comparison of the ratios of Hg:Cr in moss (adjusted for background contamination) with those in driveway surface scrapings revealed that mercury contaminated surface dust could have accounted for much of the moss bag mercury contamination.

In light of the 1985 moss bag data and comparisons of the moss and soil dust data, it was concluded that Nuodex was a minor source of atmospheric mercury emissions. The moss data for 1985 also suggested that emissions from Nuodex were not a significant source of cadmium, calcium, chromium, copper, lead, molybdenum, nickel and zinc.

1986 Moss Bag Survey and Results

On June 4, 1986 a single moss bag was placed at a height of about 3 m (10') at all sites established in 1985 (see Figure 1). The bags were replaced approximately every 30 days through to October 7, 1986. All bags taken down at the end of each exposure period were submitted to the Laboratory Services Branch to be analyzed for mercury, cadmium, chromium, copper, lead, molybdenum, nickel and zinc on a dry weight basis.

As shown in attached Table I, mercury levels generally were higher at moss sites in the vicinity of Nuodex (Site 1, 3, 6, 7, 8) than at more remote sites, suggesting that Nuodex emissions are a source of mercury. However, on the basis that the highest mean mercury levels which were detected at Sites 3 (0.31 ppm) and 6 (0.29 ppm) only were slightly elevated compared to the corresponding background levels (0.13 ppm at Site 10; 0.15 ppm at Site 14) and to the upper limit of normal for rural moss (0.2 ppm), it is concluded, as in 1985, that Nuodex was a minor source of mercury emissions in 1986.

Table 1 further shows that mercury levels at all moss sites were lower in 1986 than in 1985. It is likely that the reduction was due to a decrease in contamination by soil-dust re-entrainment in 1986 and to the above normal amount of rainfall received during June through October.

As in 1985, the 1986 moss bag results for the other metals (cadmium, chromium, copper, lead, molybdenum, nickel, zinc) suggested that Nuodex emissions were not a significant emission source of these metals. At moss Site 11, as in 1985, chromium and nickel levels were elevated, perhaps due to emissions from the metal recycling plant situated to the west. All other results shown in Table 2, as in 1985, were within a normal range for an urban environment.

Summary

The moss bag survey results for 1986, as in 1985, indicated that Nuodex is a minor source of mercury emissions. The moss bag results for both years also suggested that ambient emissions from Nuodex were not a significant source of cadmium, calcium, chromium, copper, lead, molybdenum, nickel or zinc. In light of these results, the moss bag survey will not be continued unless requested by the Central Region.

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TABLE I

Total Mercury Concentrations Detected at Each Moss Bag Site in the Vicinity of Nuodex Canada Ltd., for Each Monthly Exposure Period - June-October, 1986.

Sites (See Figure I)	Total Hg Concentration in Moss (parts per million - dry wt. basis)					
	July 4[a]	Aug. 6	Sept 8	Oct 7	Mean 1986	Mean[b] 1985
1	0.24	0.28	0.16	0.19	0.22	0.57
2	0.17	0.21	0.15	0.13	0.17	0.75
3	0.23	0.42	0.28	0.30	0.31	1.25
4	0.15	0.20	0.15	0.22	0.18	0.43
5	0.17	0.14	0.11	0.12	0.14	0.26
6	0.35	0.38	0.22	0.21	0.29	0.84
7	0.31	0.31	0.20	0.21	0.26	0.39
8	0.44	0.17	0.22	0.20	0.26	0.38
9	0.25	0.30	0.17	0.19	0.23	0.32
10	0.12	0.14	0.14	0.11	0.13	0.16
11	0.26	-	0.14	0.11	0.17	0.39
12	0.12	0.18	0.12	0.11	0.13	0.29
13	0.14	0.16	0.11	0.12	0.13	0.24
14	0.20	0.16	0.11	0.13	0.15	0.21
Upper Limit of Normal - rural area			0.2*			

a Dates moss bags were exchanged in 1986.

b 1985 means are based on five monthly (June-November) exposure periods.

* No mercury guideline for urban moss has been established by the Phytotoxicology Section.

TABLE 2 - Comparison of 1986 (June-October) and 1985 (June-November) Means for Other Elemental Levels Detected Monthly in Moss Exposed in the Vicinity of Nuodex Canada Ltd.

Sites (See Figure I)	Mean Concentration in Moss (parts per million, dry weight)													
	Cadmium		Chromium		Copper		Lead		Molybdenum		Nickel		Zinc	
	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986	1985
1	0.5	0.4	6	6	7	8	33	32	0.5	0.5	5	3	51	48
2	0.5	0.4	4	4	6	9	36	30	0.5	0.5	4	3	51	57
3	0.5	0.6	4	5	8	9	34	39	0.5	0.5	4	4	75	90
4	0.7	1.0	4	4	7	8	40	45	0.5	<0.5	4	3	108	110
5	0.5	0.4	5	5	9	12	40	46	0.5	0.5	4	3	79	104
6	0.5	0.7	4	4	7	10	36	43	0.6	<0.5	4	3	70	85
7	1.3	0.6	4	4	14	12	40	34	0.6	0.5	4	3	114	90
8	0.8	0.8	6	6	9	12	49	48	0.7	0.6	6	4	205	226
9	0.5	0.4	5	5	9	10	46	43	0.6	0.5	4	4	80	91
10	0.6	0.4	5	5	9	10	46	43	0.6	0.5	5	4	169	125
11	0.7	0.9	8	11	26	31	53	55	1.1	1.2	17	25	147	158
12	0.4	0.3	5	5	7	9	34	33	0.5	<0.5	4	4	56	63
13	0.4	0.4	4	5	7	11	38	39	0.5	0.5	4	3	57	61
14	0.7	0.5	6	6	19	26	51	55	0.7	0.7	5	4	125	157
ULN*	4		7		60		200		a		13		800	

*ULN - "Upper limit of normal" for urban moss

[a] No guideline for molybdenum in urban moss has been established by the Phytotoxicology Section

Figure 1: Moss Bag Sites in Relation to Nuodex Canada Ltd. - 1985 & 1986.

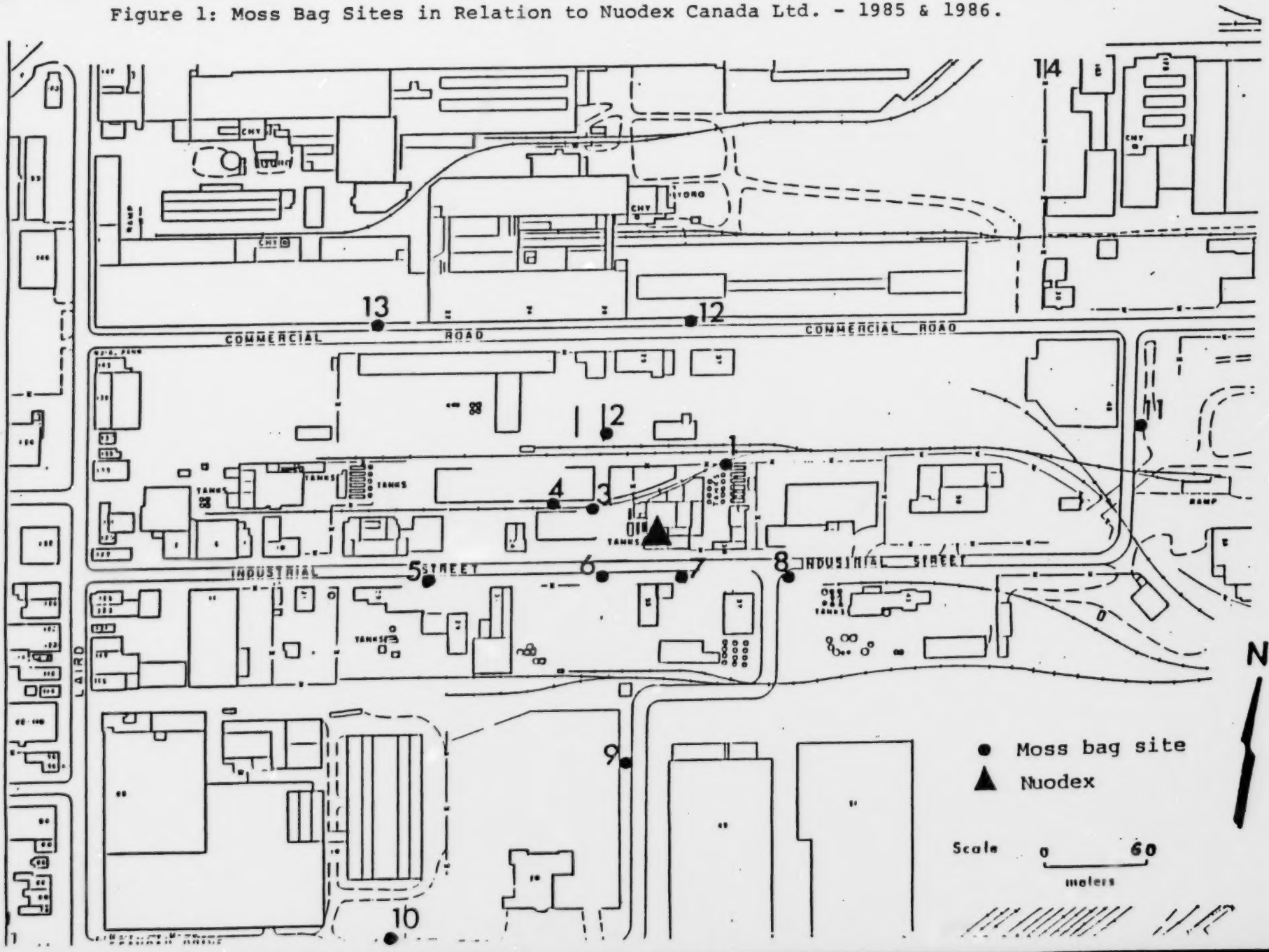

Figure 2: Approximate Driveway Sampling Locations in Relation to Nuodex - October 7, 1985.